

Consumer Chemistry (Semesters I & II.)

Both Semesters

I. Course Length:

1 year (Four 9-weeks, 5 Class periods / week)

II. Grade Level: 10

III. Credits: 1.0 credit per year

IV. Course Description:

This is an introduction course to basic consumer chemistry designed for students NOT planning on attending a 4 year college or any post graduation schooling requiring a lab. The class will be conducted in such a way that a student with minimal science background can successfully complete the class if they put forth the necessary effort. Prerequisites: **C or better** in the following course - Biology

V. Course Outline:

Semester I.

Unit 1:

Objectives: After successful completion of this unit the student will be able to:

1. **Understand the difference between precision and accuracy.**
2. **Convert between Standard and Scientific notation.**
3. **Perform mathematic operations involving significant figures.**
4. **Understand the fundamental principles of the metric and SI systems.**
5. **Solve problems utilizing dimensional analysis and factor labeling.**

A. Measurements in chemistry

1. Precision
2. Accuracy
3. Standard notation
4. Scientific notation
5. Converting
 - a. Standard notation to Scientific notation
 - b. Scientific notation to standard notation

B. SI system

1. Length
2. mass
3. volume
4. time
5. current
6. temperature
7. amount of substance

C. SI system Derived units

1. Area
2. Density
3. Pressure

D. Chemistry Problem solving

1. Dimensional Analysis
2. Factor label method
3. Handout problem solving strategies

Unit 2:

Objectives: After successful completion of this unit the student will be able to:

- 1. Differentiate between the various branches of chemistry.**
- 2. Understand what pure and applied chemistry are.**
- 3. Apply the Scientific method to solve problems.**

E. Chemistry intro

1. Defined
2. Father of Chem.
3. Chem. All around us
4. Chem. Contribution to other sciences

F. Branches of Chemistry

1. Biochemistry
2. Organic Chemistry
3. Inorganic Chemistry
4. Physical Chemistry
5. Analytical Chemistry
 - a. Qualitative
 - b. Quantitative

G. Pure vs. Applied Chemistry

H. Scientific Method

1. Intro (Computer printer ANAOLGY)
2. Definition
3. Observation
4. Hypothesis
5. Experiment

6. Conclusion
7. Theory
8. Law
9. Theory vs. Law

Unit 3:

Objectives: After successful completion of this unit the student will be able to:

1. Explain the principle theories of atomic structure and electron notation.
2. Define the various subatomic particles.
3. Use the periodic table to find atomic mass, atomic number and so on.
4. Identify uses for various isotopes.
5. Calculate formula mass.
6. Explain the laws of “Conservation of Matter and Energy”
7. Identify the various types of matter (e.g., homogeneous, heterogeneous) and methods for their separation.
8. Identify physical and chemical properties of matter.
9. Determine the difference between a fluid and a liquid, a gas and a vapor.
10. Separate a mixture by physical means (e.g., filtration, distillation)

I. Matter

1. Defined
 - a. Mass
 - b. Weight
2. Heterogeneous vs. Homogeneous
3. Heterogeneous
 - a. Mixtures (heterogeneous)
4. Homogeneous
 - a. Solutions
 - b. Pure Substances
 - c. Elements

J. Atoms, Intro

1. Defined
2. Theories
 - a. Dalton
 - b. Bohr
 - c. Rutherford

K. Atoms

1. Subatomic particles
 - a. Electrons
 - b. Protons
 - c. Neutrons
 - d. Relative electrical charge

L. Structure of the Atom

1. Nucleus
2. Rutherford's Foil experiment

M. Atomic Number

1. Name
2. Symbol
3. Atomic Number
4. Protons
5. Neutrons
6. Mass Number
7. Finding Numbers of Protons, Neutrons, Electrons

N. Mass Number

1. Define

O. Isotopes of the Elements

1. Defined
2. Examples
 - e. Hydrogen
 - f. C

P. Atomic Mass

1. Atomic Mass Unit
 - a. Defined
 - b. Nature, Elements, and Isotopes

Q. Calculating the Atomic Mass of an Element

1. Examples

SEMESTER I & II OVERLAP

Unit 5:

Objectives: After successful completion of this unit the student will be able to:

- 1. Explain the mole concept.**
- 2. Interconvert moles and mass.**
- 3. Use standard molar volume (22.4 l = 1 mole) to convert moles to volume of gas at standard conditions.**
- 4. Use moles and interconvert between grams, liters of a gas, and number of particles.**
- 5. Understand the fundamental principles of electrochemistry. (e.g., electrolytic and voltaic cells, cathodes and anodes.)**
- 6. Classify $\frac{1}{2}$ cells reactions and reduction or oxidation.**

A. Ions (Polyatomic)

1. Cation
2. Anion
3. Polyatomic ions

B. Mole

1. Defined
2. Avagadro's number
3. gram atomic weight

C. Molarity

1. defined
2. relation to grams per unit volume
3. solving mole/ Molarity problems (dilutions, concentrations)

D. DIMO

1. Acronym defined
2. use in converting
 - i. grams, liters, # of particles to mole
 - ii. # of moles to grams, liters, # of particles

E. Electrochemistry

1. Defined
2. electrolytic cell
3. voltaic/ galvanic cell
4. cathodes/ anodes

F. Redox reactions in electrochemical cells

1. Oxidation
2. Reduction
3. $\frac{1}{2}$ cell reactions
4. cell potentials

SEMESTER II.

Unit 6:

Objectives: After successful completion of this unit the student will be able to:

1. Identify and differentiate the basic types of chemical bonds: ionic and covalent.
2. Understand the relationship between bonding and physical properties.
3. Indicate how electrons are shared and transferred to form bonds.
4. Identify the types of chemical bonds in common substances (e.g., Sodium chloride, Carbon dioxide, Methane)
5. Show how bonding determines physical properties.
6. Name chemical compounds from formulas (e.g., NaCl is Sodium chloride)
7. Write chemical formula for compounds (e.g., Sodium chloride is NaCl)
8. Identify the type of electron distribution in a given substance (e.g., polar, ionic)
9. Apply the concepts of basic chemical nomenclature.

G. Chemical Bonds (General Overview)

1. Chemical Bonds Defined
2. Two Types of Bonds
 - a. Ionic
 - b. Covalent
3. Specific Bonds form when...
 - a. Metal to Non-Metal
 - b. Non-Metal to Non-Metal
 - c. Metals \neq DO NOT bond with Metals
 - d. Chart for indications of specific bonds
4. Electronegativity
 - a. Defined
 - b. Trend with periodic chart
 - c. Use in determining bonds

H. Ionic Bonding

1. Remember definition and when they occur.
2. Ionic Compounds defined
3. Ionic Bonds use valence electrons
4. Refresher: Difference between Metals and Non-Metals
 - a. Location on Periodic Chart
 - b. Number of valence electrons, and the number desired
 - c. "Gain" or "Give"
5. Cation - Ion Formation
6. Stoichiometry ("Balancing")
7. Nomenclature of simple ionic compounds ("Naming Compounds")

I. Covalent Bonding

1. Remember definition and when they occur.
2. Covalent Compounds defined
3. Covalent Bonds use various electrons
4. Refresher: Difference between Metals and Non-Metals
 - a. Location on Periodic Chart
 - b. Number of valence electrons, and the number desired
 - c. Everyone needs. Know one “Gains” or “Gives”. ALL SHARE.
5. Stoichiometry (“Balancing”)
6. Nomenclature (“Naming Compounds”)

Unit 8:

Objectives: After successful completion of this unit the student will be able to:

1. **Identify and differentiate the various symbols used in a chemical equation.**
2. **Apply the principles of Stoichiometry.**
3. **Write balanced chemical equation show that atoms are conserved in chemical reactions.**
4. **Perform titrations to determine the concentration of an unknown acid or base.**

J. Chemical Equation

1. Defined
2. Basic Terms
3. Frequently used Symbols

K. Balancing Chemical Equations

1. Remember “Nomenclature” and “Stoichiometry”
2. Basic Rules
3. Setting up the “Chart”
4. Balancing Practice and Examples

Unit 9:

Objectives: After successful completion of this unit the student will be able to:

1. Identify the basic types of chemical reactions.
2. Define and differentiate the types of chemical reactions (e.g., single and double replacement, combination/synthesis, decomposition)
3. Use the activity series to predict reactivity.
4. Predict mass and/or volume of a species in chemical reactions.
5. Calculate percent yields and identify limiting reagent.
6. Perform calculations involving concentrations of solutions. (e.g., molarity, actual yield)
7. Classify and predict what type of reaction will occur. (e.g., decomposition, combination, single replacement, double replacement, reversible, and redox)
8. Identify and determine products and write balanced equations for reactions.
9. Explain the heat change in a chemical reaction.

L. Types of Reactions

1. Endothermic
2. Exothermic
3. Combustion
4. Synthesis
5. Decomposition
6. Single Replacement
7. Activity Series
8. Double Replacement
9. Redox. (Oxidation / Reduction)

Unit 10:

Objectives: After successful completion of this unit the student will be able to:

1. Describe the various relationships among the variables that describe gases (e.g., pressure, temperature, volume, and moles.)
2. Define the Universal Gas Constant.
3. Predict the physical state and properties of a substance at a given temperature by consideration of pressure, volume, and temperature.
4. Understand the concept of an Ideal Gas.
5. Differentiate between a gas and a vapor.
6. Use "The Gas Laws" to predict the pressure, volume, temperature and amount of a gas at specific conditions.
7. Explain how the observed properties of gases (e.g., expansion, pressure, low density, and diffusion) relate to the physical and chemical properties of a gas.

M. Intro

1. Remember:
 - a. 3 states of matter
 - b. Differences in energy and atom/molecule proximity

N. Basic Terms

1. Pressure
2. volume
3. Mole
4. Universal gas constant
5. Temperature
6. STP
7. Ideal gas

O. Observed Properties of Gases

1. Expansion
2. Pressure
3. Low Density
4. Diffusion

P. Kinetic Theory (Description of a Gas)

1. Defined
2. Specific assumptions
3. Attractive forces (Effect)

Q. Ideal Gas Law

1. Definition
2. Examples

VI. Assessment:

57% Homework / classroom work

10% Preparedness for class (this includes: bringing a pencil, dedicated notebook, calculator, and being in class as well as on time. Absent for any reason (except early dismissal for an athletic event) will result in a zero for the day).

33% Quizzes / Tests

100% Total